

REMARKS

Reconsideration and allowance of the subject application in view of the foregoing amendments and the following remarks is respectfully requested.

Claims 1-14 remain pending in the application. Claims 15-26 have been cancelled.

Figures 1-3B have been labeled as "PRIOR ART". The drawings were mislabeled as originally filed. A proposed drawing correction with the corrected drawings is being submitted concurrently herewith.

The disclosure was objected to because of the noted informalities. Figure 4A was mislabeled as Figure 2(a), Figure 4B was mislabeled as Figure 2(b), Figure 4C was mislabeled as Figure 2(c), Figure 5A was mislabeled as Figure 3(a), Figure 5B was mislabeled as Figure 3(b), Figure 5C was mislabeled as Figure 3(c), Figure 5D was mislabeled as Figure 3(d) and Figure 5E was mislabeled as Figure 3(e). Figures 1-3 are all conventional coil arrangements. These Figures are now Figures 1, 2, 3A and 3B. The invention is shown in Figures 4A, 4B, 4C and 5A-5E. The numerous reference numbers in the specification should be made clear by the proposed drawing amendments.

Claims 1 and 8 have been amended to place the claimed invention in a better form for readability and resubmitted for reconsideration. The specification has also been modified and placed in a better form for readability. Typographical and grammatical errors have been corrected in the specification. No new matter has been introduced to this patent application by this Amendment.

The Examiner rejected claims 1-26 under 35 U.S.C. § 102(b) as being anticipated by Nakao et al. (U.S. Patent No. 5,939,804). Applicant respectfully traverses the rejection.

The present invention is directed to an electromagnetic actuator for moving an object along a first direction (i.e., a focusing direction) and a second direction (i.e., a tracking direction) that includes a magnetic force line generator including two homopolar parts spaced with a clearance small enough for generating magnetic force lines including a first substantially linear portion (i.e., the smooth portions 215 of Figure 4A) and a second substantially linear portion (i.e., the smooth portions 216 of Fig. 4A) due to a repelling force between the two homopolar parts, wherein the first and second substantially linear portion are not parallel; a first actuating coil set (i.e., the coil 22 of Fig. 4A) connected to the object (not shown) and arranged around the magnetic force line generator with a coil wall thereof substantially perpendicular to the first substantially linear portion for moving the object in the first direction in response to a first current density therein and the first substantially linear

portion; and a second actuating coil set (i.e., the coils 231, 232 of Fig. 4A) connected to the object and located at the lateral end of the magnetic force line generator with a coil wall thereof substantially perpendicular to the second substantially linear portion for moving the object in the second direction in response to a second current density and the second substantially linear portion, wherein the first and second actuating coil sets are not substantially parallel.

Nakao et al., on the other hand, is directed to a linear actuator in a simple structure with an excellent S/N characteristic has a movable coil incorporating a pair of magnetic circuits 8a and 8b. The magnetic circuit 8a comprises yokes 6a and 7a, and a magnet 5a of which polarization direction is vertical with regard to a driving direction. The magnetic circuit 8b has the same structure as 8a. There is only disclosure of the first actuating coil sets (8a, 8b).

Applicant submits that the reference does not show all the limitations of the present invention as required by the amended claims 1 and 8. First, the reference does not show the first and second actuating coil sets are not substantially parallel as required by the amended claims 1 and 8. The amended claims 1 and 8 recite in part "a second actuating coil set connected to said object..., wherein said first and second actuating coil sets are not substantially parallel...." Second, Applicant submits the reference does not show a second substantially linear portion of magnetic force lines (a second magnetic force) is not substantially parallel with a first substantially linear portion of magnetic force lines (a first magnetic force) as required by the amended claims 1 and 8. The amended claims 1 and 8 recite in part:

"a magnetic force line generator including two homopolar parts spaced with a clearance small enough for generating magnetic force lines including a first substantially linear portion (a first magnetic force) and a second substantially linear portion (a second magnetic force) due to a repelling force between said two homopolar parts, wherein said first and second substantially linear portion are not parallel;...."

In fact, the second substantially linear portion of magnetic force lines is the leakage flux in Fig. 7) in Nakao et al. Therefore, the present invention is more efficient than the invention of Nakao et al.

In view of the above, Nakao et al. does not teach or disclose that the second actuating coil sets for the leakage flux like the present invention. Therefore, the newly amended claims 1 and 8 are patentable over Nakao et al.

All objections and rejections having been addressed, it is respectfully submitted that the present application should be in condition for allowance and a Notice to that effect is earnestly solicited.

To the extent necessary, a petition for an extension of time under 37 CFR 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 07-1337 and please credit any excess fees to such deposit account.

Respectfully submitted,

LOWE HAUPTMAN GILMAN & BERNER, LLP

A handwritten signature in black ink that reads "Kenneth M. Berner". The signature is written in a cursive, flowing style.

Kenneth M. Berner
Registration No. 37,093

Date: April 1, 2003
1700 Diagonal Road, Suite 310
Alexandria, Virginia 22314
Telephone: (703) 684-1111
Facsimile: (703) 518-5499
KMB:JD

MARKED-UP VERSION SHOWING CHANGES

IN THE SPECIFICATION

Please amend the specification as follows.

Page 4, amend last paragraph (lines 14-27) continuing onto page 5, lines 1-3 as follows:

According to a second aspect of the present invention, an electromagnetic actuator is provided for moving an object along a first direction and a second direction. The electromagnetic actuator includes a magnetic force line generator including two homopolar parts spaced with a clearance small enough for generating magnetic force lines including a first substantially linear portion and a second substantially linear portion due to a repelling force between the two homopolar parts[;], wherein the first and second substantially linear portion are not parallel; a first actuating coil set connected to the object and arranged around the magnetic force line generator with a coil wall thereof substantially perpendicular to the first substantially linear portion for moving the object in the first direction in response to a first current density therein and the [magnetic force lines] first substantially linear portion; and a second actuating coil set connected to the object and located at the lateral end of the [arranged around the] magnetic force line generator with a coil wall thereof substantially perpendicular to the second substantially linear portion for moving the object in the second direction in response to a second current density [therein and the magnetic force lines] and the second substantially linear portion, wherein the first and second actuating coil sets are not substantially parallel.

Page 5, amend first full paragraph (lines 4-17) as follows:

According to a third aspect of the present invention, an electromagnetic actuator for moving an object along a first direction and a second direction includes a first actuating coil set connected to the object for generating a first actuating force to move the object in the first direction in response to a first current therein and a first magnetic force; a second actuating coil set connected to the object for generating a second actuating force to move the object in the second direction in response to a second current therein and a second magnetic force, wherein the first and second actuating coil sets are not substantially parallel; and a magnetic force line generator including two spaced homopolar parts which is surrounded by the first actuating coil set, and sandwiched by the second actuating coil set for providing the first and second magnetic forces for the first and second actuating coil sets, respectively, by generating

magnetic force lines due to a repelling force therebetween, wherein the first and second magnetic forces are not substantially parallel.

Page 6, amend first full paragraph (lines 3-6) as follows:

Figures 4A~4C are schematic diagrams showing the coil arrangement of a preferred embodiment of an electromagnetic actuator according to the present invention wherein Fig. [3B] 4B is a cross-sectional view taken along [an] a [B-B] B-B' line of Fig. [3A] 4A and Fig. [3C] 4C is a top plane view of Fig. [3A] 4A;

IN THE CLAIMS

Please amend claims 1 and 8 as follows:

1. (Amended) An electromagnetic actuator for moving an object along a first direction and a second direction, comprising:

a magnetic force line generator including two homopolar parts spaced with a clearance small enough for generating magnetic force lines including a first substantially linear portion and a second substantially linear portion due to a repelling force between said two homopolar parts, wherein said first and second substantially linear portion are not parallel;

a first actuating coil set connected to said object and arranged around said magnetic force line generator with a coil wall thereof substantially perpendicular to said first substantially linear portion for moving said object in said first direction in response to a first current density therein and said [magnetic force lines] first substantially linear portion; and

a second actuating coil set connected to said object and [arranged around] located at the lateral end of said magnetic force line generator with a coil wall thereof substantially perpendicular to said second substantially linear portion for moving said object in said second direction in response to a second current density therein and said [magnetic force lines] second substantially linear portion, wherein said first and second actuating coil sets are not substantially parallel.

8. (Amended) An electromagnetic actuator for moving an object along a first direction and a second direction, comprising:

a first actuating coil set connected to said object for generating a first actuating force to move said object in said first direction in response to a first current therein and a first magnetic force;

a second actuating coil set connected to said object for generating a second actuating force to move said object in said second direction in response to a second current therein and a second magnetic force, wherein said first and second actuating coil sets are not substantially parallel; and

a magnetic force line generator including two spaced homopolar parts which is surrounded by said first actuating coil set, and sandwiched by said second actuating coil set for providing said first and said second magnetic forces for said first and said second actuating coil sets, respectively, by generating magnetic force lines due to a repelling force therebetween, wherein said first and second magnetic forces are not substantially parallel.